The management of childhood asthma – what is new?

Steve Turner

Abstract

Childhood asthma is a common condition where there is no consensus on definition, no diagnostic test and no reliable test to monitor symptoms. Despite (or because of) these considerable clinical challenges, many national bodies produce guidelines for the diagnosis and management of childhood asthma. The British Thoracic Society and Scottish Intercollegiate Guidelines Network (BTS/SIGN) published their first asthma guideline in 1995 and have updated regularly, and most recently in 2016. The present article will (i) summarise changes in the BTS/SIGN asthma guideline between 1995 and 2014 and (ii) highlight what has changed between 2014 and 2016. The guideline has evolved considerably over 21 years, but the core principles for diagnosis and management have remained constant. The major changes to the 2016 guideline include (i) the initial trial of treatment should be with inhaled corticosteroids (ICS) (ii) there is new terminology for the dose of ICS (iii) there are new recommendations for the traditional "steps" 1 to 3 and (iv) the 5–12 and less than 5 year old stepwise algorithms in the 2014 guideline are now unified. For acute severe asthma, the first choice intravenous treatment is magnesium sulphate. Childhood asthma remains a clinical diagnosis where management is symptom-based and patient-focussed.

Keywords asthma; child; evidence-based medicine; guideline; pulmonary function testing; treatment

Background – a historical backdrop

The first UK guideline for childhood asthma diagnosis and management was produced in 1989, and this was timely since childhood asthma prevalence in the UK and Western world was rising rapidly at that time. There were two major reasons for the rise in asthma prevalence in the 1980s, firstly there was a genuine increase in the proportion of children with asthma and secondly there was a shift in the threshold for diagnosing asthma. The realisation that asthma did occur in children and responded to asthma treatment lead to a change in clinical thinking from "you can't diagnose asthma in a child under X years" (where X was somewhere between 5 and 10 years) to "if it is chronic and respiratory and paediatric it is asthma". The 1989 guideline provided clinicians a framework for diagnosing and also treating the "new" condition of childhood asthma. In 1990 the British Thoracic Society (BTS) published their first guideline on asthma management for adults.

Steve Turner *MD is a Respiratory Paediatrician, Child Health, Royal Aberdeen Children's Hospital, Aberdeen, UK. Conflicts of interest: He is a member of the BTS/SIGN guideline steering group.*

Adult and paediatric physicians worked with Scottish Intercollegiate Guidelines Network (SIGN) and published the first BTS/SIGN guideline on the management of asthma in 1995 (eventually published in 1998). The ground-breaking 1995 guideline, with its evidence-based approach and step-wise management, has become a core part of medical education in the UK and many other countries. The guideline was updated by changing existing text or by the addition of new chapters in 2003, 2008, 2009, 2012, 2014 and 2016. Table 1 summarises how the guideline has changed over time. Figure 1 demonstrates that the guideline has reached a steady state for page number since 2012. A more compact "quick reference" guideline has accompanied the 2014 and 2016 publications. The guidelines published in 2009 and 2012 were strictly updates of the 2008 guideline, and were produced in order to keep up with the evidence base.

The BTS/SIGN guideline is not the only international consensus document but its recommendations are very similar to those published in the USA (The Global Initiative for Asthma, first published in 1995), Australia (The Australian Asthma Handbook, first published in 1990) and Europe (The PRACTALL consensus report, first published in 2008).

Keeping abreast of changes in guidelines

Looking at Table 1, there are a number of recommendations which have persisted, e.g. asthma is a clinical diagnosis, objective tests have little/no role in diagnosis, management is patient-centred and based on regular review with a step up/step down approach. The prevalence of childhood asthma and the number of children admitted to hospital have fallen in the UK since the late 1990s, and this may be in part due to the introduction of the guideline leading to more accurate diagnosis and improved management. However it is important to note that changes in the guideline, e.g. the introduction of new treatments such as long acting beta agonists (LABA) and leukotriene receptor antagonists (LTRA), do not lead to abrupt changes in practice; clinicians had anticipated the introduction of LABA and LTRA and prescribed these medications in children for several years before they appeared in the guideline. There is an inevitable lag between changes in the guideline and practice, and Table 1 also identifies a number of practices which are no longer recommended but nonetheless persist, e.g. removing carpets, doubling inhaled corticosteroid (ICS) dose during exacerbation. Therefore whilst the guideline is appreciated by clinicians (it receives considerably more "hits" than any other SIGN guideline), "real-world" practice often differs, perhaps reflecting the challenge in keeping up with changes. This review will now summarise changes in the 2016 guideline relevant to children, and not discuss changes which only affect adults.

So what is new in 2016?

Asthma diagnosis

When comparing the "key recommendations" in the 2014 and 2016 guidelines, the greatest number of changes involve diagnosis. However, there has been no watershed moment here, and the diagnosis of asthma is still based on the history of recurrent cough and wheeze associated with shortness of breath and careful consideration of alternative diagnoses. The guideline previously had separate diagnostic algorithms for adults and children

A summary of some of the child relevant changes to each revision of the BTS/SIGN asthma guideline

	Additions (and one deletion*)	Statements strengthened or weakened	Constant throughout
1995	• Asthma control first mentioned • Stepwise management for children aged less than 5 years. Older children treated as adults • Child defined as aged up to 15 years (for acute management only)	• "Patients should double their dose of ICS temporarily if their asthma deteriorates or at the first sign of an upper respiratory tract infection (1995)" "doubling the dose at the time of an exacerbation is of unproven value (2008)"	• The diagnosis is based on a history • There is no reliable objective test • Lack of therapeutic response may indicate an alternative diagnosis • Antibiotics and antihistamines are not indicated • A self-management plan/action plan should be agreed with the patient • Children should not be exposed to cigarette smoke • Ask about compliance/adherence
2003	• Concept of intermediate probability of an asthma diagnosis. • Long acting beta agonists and leukotriene receptor antagonists included as treatment options. • *Sodium cromoglycate no longer recommended (previously the first choice preventer). • For stepwise management, child defined as aged less than 12 years. Separate algorithms for under 5s and 5 to less than 12 year olds • For acute management, separate guidelines for less than 2, 2—5 and more than 5 years old • Consider stepping down after three months • List of alternative diagnoses provided	• Pulsus paradoxus from "not useful" in 1993 to "need not be measured" from 1995 to "abandoned as an indicator of severity" by 2003 • Peak flow to be more than 50% predicted prior to discharge after admission in 1995, more than 75% in 2003 and in 2016 "no single physiological parameter defines absolutely the timing of discharge" • For day-to-day management, "nebulisers are overused" (1993) "nebulisers are rarely needed" (1995) nebulisers not mentioned in the context of "stable asthma" by 2003 • For house dust mite measures "committed families" could remove carpets, remove soft toys form bed, dehumidify, etc (2003) becomes "Physical and chemical methods of reducing house dust mite levels in the home are ineffective and should not be recommended (2014, Level A evidence) • For air ionisers "anecdotal evidence that some patients have benefited" (1993), "Cannot be encouraged " (2003) and "air ionisers are not recommended (2008, level A evidence)	
2008	• "Watchful waiting" for the child with mild and non-specific symptoms recommended • Intravenous magnesium sulphate for acute severe asthma introduced • Consider chest X ray for severe acute asthma • New section on difficult asthma • New chapter on non- pharmacologic management. • Computer repeat-prescribing systems provide a practical index of adherence		
2009	• Influenza vaccine administered "independent of any consideration related to asthma" • Combine ipratropium bromide and salbutamol ("Combineb") three times in an hour for acute severe asthma • "Leukotriene receptor antagonist (LTRA) may be used for mild asthma exacerbations (2009)".		
2012	• New section on adolescent asthma (first mention of transitional care) • Anti IgE monoclonal antibody recommended under certain circumstances		
2014	• "Asthma attack" used instead of "asthma exacerbation"		
2016	• Trial of ICS for diagnosis • First treatment step is very low dose ICS • For severe asthma, the first choice intravenous treatment is magnesium sulphate		

Table 1

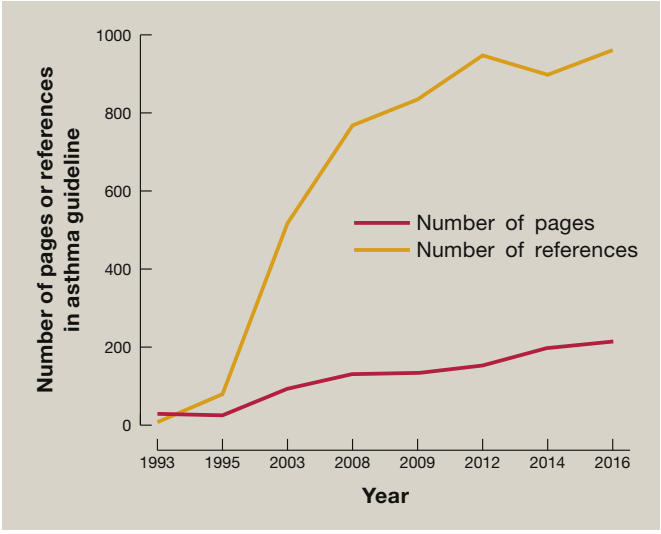

Figure 1 Changes in a number of indices of the size of the asthma guideline from 1990 to 2016. The 1990 article was solely for children and subsequent guidelines were for adults and children. The British Thoracic Society and Scottish Intercollegiate Guidelines Network produced a joint guideline in 2003 and thereafter.

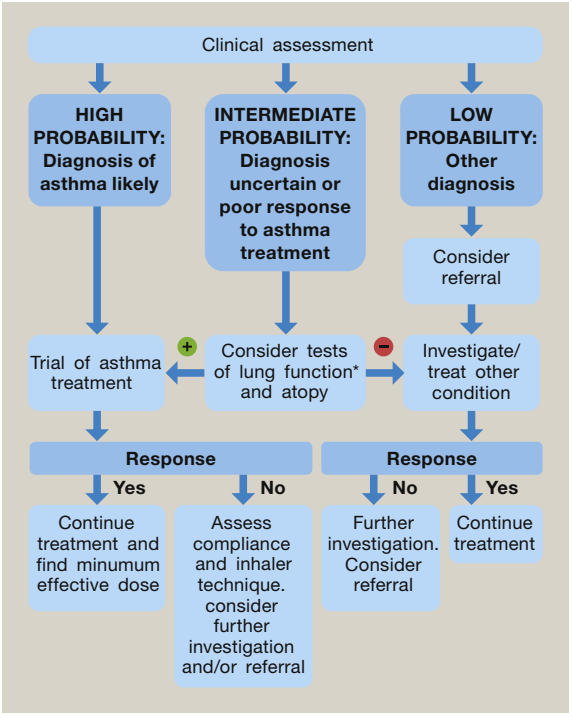

Figure 2 The algorithms for asthma management in children in the 2014 British Thoracic Society/Scottish Intercollegiate Guidelines Network Asthma guideline. Reproduced by kind permission of the British Thoracic Society.

(Figure 2) but these are now unified in a rather busy manner (Figure 3). The guideline "key recommendations" section for diagnosis is predominantly aimed at adults (i.e. more than 12 year olds) with asthma and suggests comparison of "diagnostic tests" when symptomatic and symptom free. The guideline now presents the sensitivities and specificities for symptoms and tests for diagnosing asthma in adults and children; what is striking is how poor individual symptoms and tests are at a single assessment for asthma in children. The guideline continues to emphasise the importance of considering multiple factors on more than one occasion before arriving at a diagnosis of asthma. The guideline also continues to make clear that there is no reliable "asthma test" and states that "normal spirometry in an asymptomatic patient does not rule out the diagnosis of asthma".

A second notable change to the diagnosis section is that the guideline has previously been vague in recommending a "trial of treatment" with review in 6 weeks to confirm the diagnosis. Importantly, the 2016 guideline is now specific in saying that this trial should be with inhaled corticosteroids.

Asthma management (chronic)

The stepwise approach to treatment has changed moderately as follows:

1. The "four step" algorithm for the under 5s and the "five steps" for the 5–12 year olds in the 2014 guideline (Figure 4) have been merged into one for the 2016 guideline (Figure 5).
2. There is a new terminology for ICS dose which provide consistency for children and adults. "Very low dose ICS" is equivalent to ≤200 microgram/day, "low dose ICS" equivalent to ≤400 microgram/day and "medium dose ICS" ≤800 microgram/day of budesonide equivalent. "High dose ICS" is ≤2000 microgram/day of budesonide equivalent and is reserved for more than 12 year olds. The recommended dose of ICS is unchanged.
3. "Step 1" is now regular preventer (very low dose ICS formerly step 2). This is a logical extension of the trial of ICS being used to diagnose asthma; if a child responds to a trial of ICS treatment they can now remain in the lowest treatment step and don't appear to "skip" the as required short acting beta agonist step (formerly step 1). Children started on low dose ICS as part of a diagnostic trial could be stepped down to very low dose ICS if they remain well controlled for three months. The guideline continues to recommend that the starting dose of ICS should be titrated against symptoms and also that the lowest dose should be used where symptoms are minor.
4. Step 2 is now "initial add on preventer", i.e. long acting beta agonist (LABA) in ≥5 year olds and leukotriene receptor antagonist (LTRA) in young children.
5. Step 3 is now "additional add on therapies", i.e. LTRA or low dose ICS in ≥5 year olds and low dose ICS in young children.
6. Steps 4 and 5 are as previously, respectively medium dose ICS and oral corticosteroids.

One other notable shift in the 2016 guideline compared to 2014 is on the approach to weight reduction. The 2014 guideline had a grade C statement which stated "Weight loss in overweight patients has many benefits and should be supported in people with asthma". The 2016 guideline has upgraded the level of evidence (to grade B) and stated that weight loss might improve asthma control "weight loss interventions can be considered for

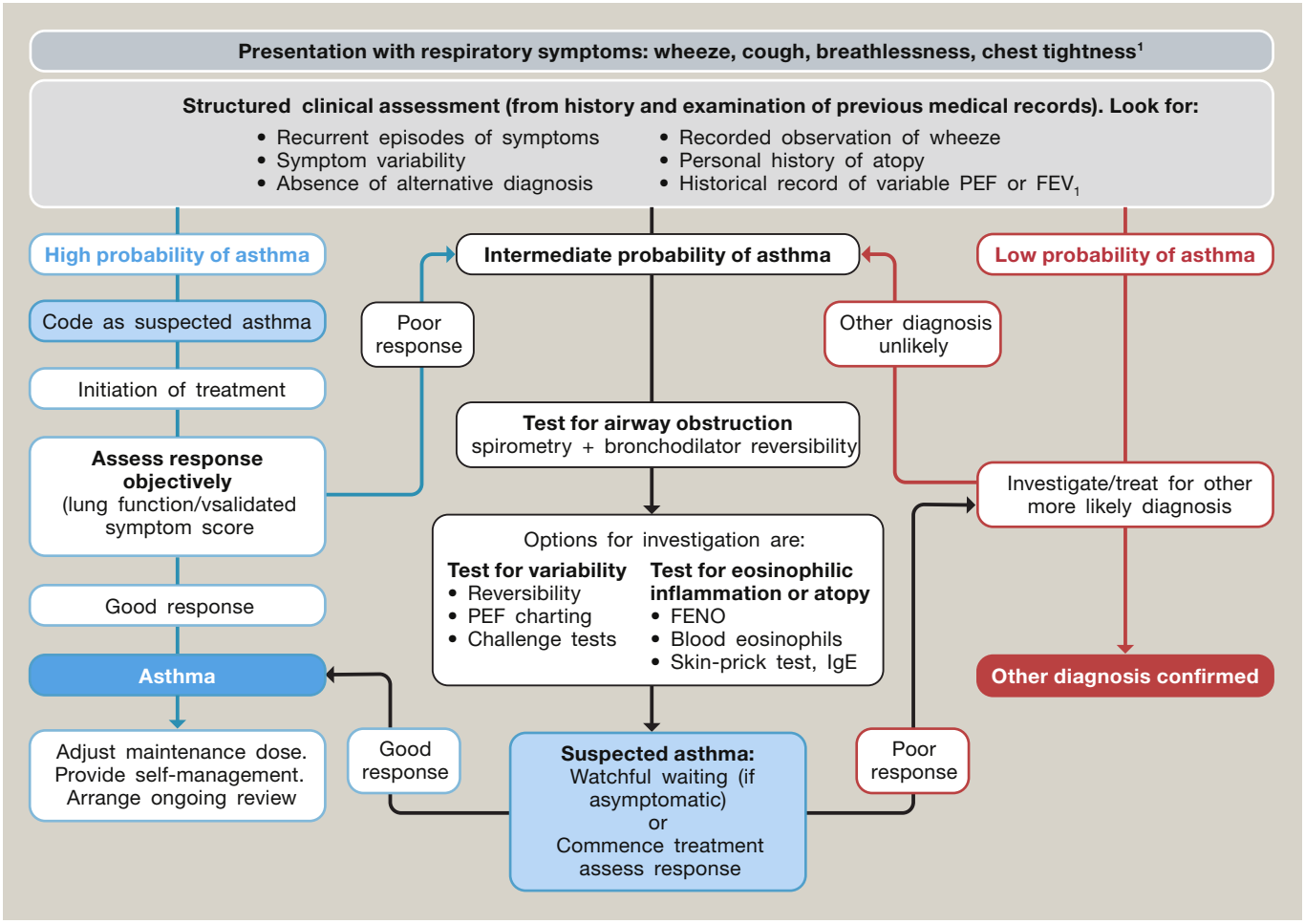

Figure 3 The algorithms for asthma management in children in the 2016 British Thoracic Society/Scottish Intercollegiate Guidelines Network Asthma guideline. Reproduced by kind permission of the British Thoracic Society.

overweight and obese adults and children with asthma to improve asthma control".

Asthma management (acute)

The only change of note is that when initial treatment with oral corticosteroids and nebulised bronchodilators have not improved the child's condition, intravenous magnesium sulphate is suggested as the first intravenous treatment on the grounds that intravenous salbutamol and aminophylline have adverse effects and one clinical trial found magnesium to be the most efficacious of the three options for symptom improvement. In the 2014 guideline, there was a section of text describing the management of acute asthma in children less than 2 years of age (which did not describe medication doses), but this section is not included in the 2016 guideline. Annexe 8 does give clinicians a guideline for managing children aged under 2 years presenting with acute severe wheeze.

The role of objective tests in the diagnosis and monitoring of asthma

The 2016 guideline describes the sensitivity and specificity of the following objective tests for childhood asthma: spirometry, peak flow, bronchodilator response, bronchial challenge, exhaled nitric oxide, skin prick reactivity, blood eosinophils and IgE. None of the tests is, perhaps not surprising given the lack of consensus on a definition for asthma the small number studies in populations of children with suspected asthma. The 2015 draft consultation on the diagnosis of asthma from the National Institute for Clinical Efficacy (NICE) included a diagnostic algorithm for children which was very reliant on objective testing and stated "do not use symptoms alone with an objective test to diagnose asthma". The draft document also stated "do not diagnose asthma based on any single diagnostic test alone". NICE piloted the feasibility of modified diagnosis and monitoring guideline in seven primary care sites across England between May and October 2016.

For monitoring of childhood asthma, symptom-based action plans are generally preferred in some contrast to adults where a personalised asthma action plan may be based either on symptoms and/or peak flows, in children. Evidence from clinical trials demonstrates that titrating asthma treatment to peak flow or exhaled nitric oxide does not improve asthma control. There is evidence that titrating treatment to exhaled nitric oxide may reduce asthma attacks but a definitive trial is required to fully explore this.

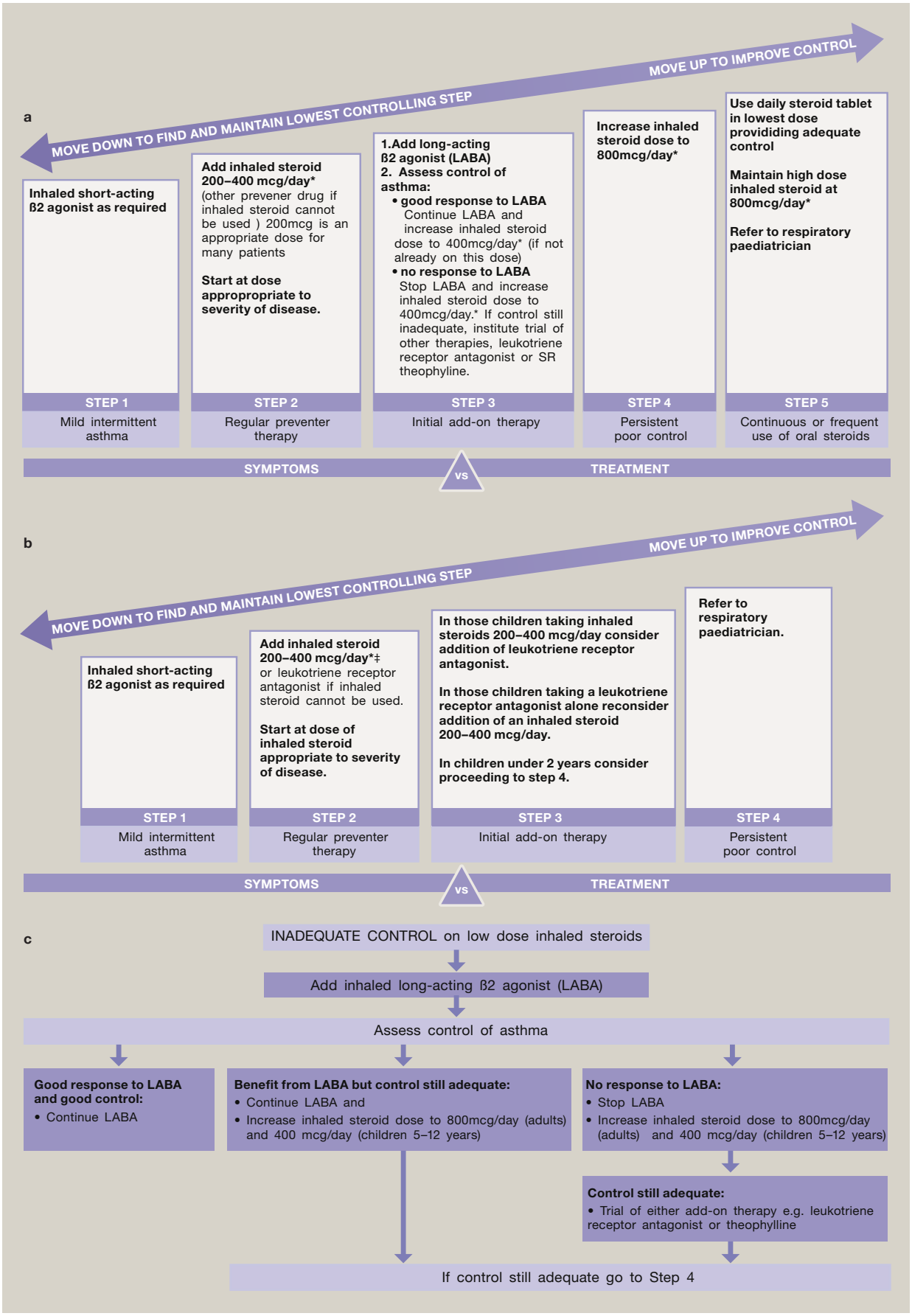

Figure 4 The algorithm for asthma diagnosis in children in the 2014 British Thoracic Society/Scottish Intercollegiate Guidelines Network Asthma guideline. Reproduced by kind permission of the British Thoracic Society. Panel (a) describes treatment steps for children aged 5–12 years. Panel (b) describes treatment steps for children aged under 5 years. Panel (c) describes step 3 treatment options for children aged 5–12 years (and adults).

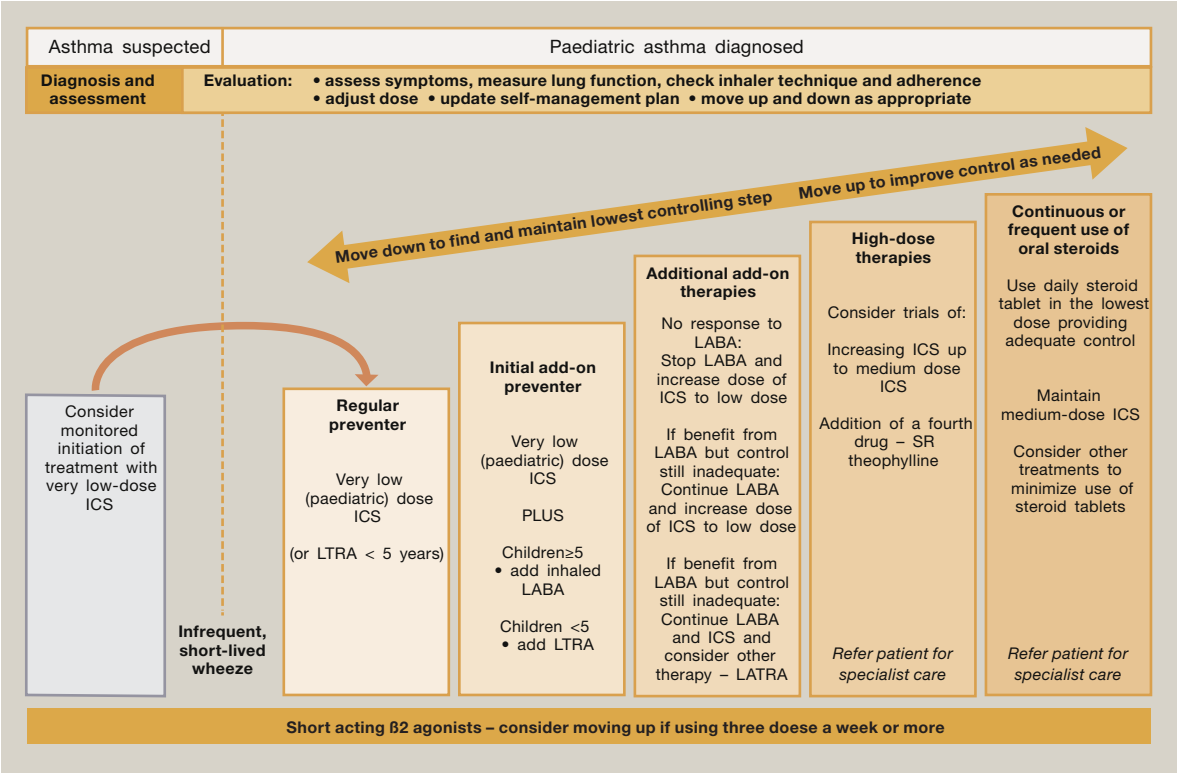

Figure 5 The algorithm for asthma diagnosis in children in the 2016 British Thoracic Society/Scottish Intercollegiate Guidelines Network Asthma guideline. Reproduced by kind permission of the British Thoracic Society.

What has not changed in 2016?

As Table 1 outlines, the foundations for the diagnosis and management of asthma are mostly unchanged since the guideline was first published. Over time, as the guideline has matured, more precise recommendations have been included. For example, the criteria for starting inhaled corticosteroids in a child with previously established asthma remains the same (i.e. using reliever ≥three times a week, being symptomatic ≥three times a week and waking ≥one night a week). Stepping up treatment remained based on the responses to closed questions such as "how many times a week are you using your reliever treatment"" "how many nights a week are you coughing?" "how many days off school have you had due to asthma in the whole of last term?" All children should have an asthma action plan. The advice about stepping down and stopping treatment remains rather vague "Decreasing therapy once asthma is controlled is recommended … there are few studies that have investigated the most appropriate way to decrease treatment" and "reductions should be considered every three months, decreasing the dose by approximately 25–50% each time".

Looking ahead

The BTS/SIGN guidelines for asthma diagnosis and management will continue to evolve as the evidence base becomes ever wider. The introduction of the NICE asthma diagnosis and monitoring recommendations may introduce a different perspective which may be more reliant on objective testing. The next iteration of the BTS/SIGN guideline may include an opinion on emerging potential strategies for managing childhood asthma, including bronchial thermoplasty, long acting muscarinic antagonists and breathing therapies. Asthma is a heterogeneous condition and future guidelines may include a section on stratified treatment where treatment (especially add on therapy) can be started in process which is more than simple "trial and error".

In conclusion

A national guideline such as the 2016 BTS/SIGN asthma guideline provides a clinical governance framework for clinicians to work within. The lack of objective tests for diagnosis and monitoring in asthma arguably make an guideline more necessary than for conditions where clinicians can be more precise, e.g. diabetes. There are limitations to any guideline which have to be acknowledged, and these include a lack of evidence in often key areas (e.g. when to steps down asthma treatment? How to manage acute wheeze in children under 2 years of age?) and keeping up to date with a rapidly changing literature. As for many conditions which are found in adults and children and mostly managed in primary care, an additional challenge is ensuring that there is consistency where possible for all ages but also ensuring there is no "creep" of practice from adults into children. As a community, we are getting better at diagnosing and managing asthma in children but keep a weather eye out for the changes in the guidelines over the horizon. ◆

Key learning points

- Asthma remains a clinical diagnosis, based on symptoms and a response to inhaled corticosteroid (ICS) treatment.
- Management of a child with asthma is focussed on the action plan with regular assessments of asthma control, inhaler technique and treatment adherence.
- There is no reliable single objective test for asthma diagnosis or monitoring.
- The 2016 guideline differs to previous versions by having very low dose ICS treatment as the initial treatment step although there is the option step down to reliever medication only after review.
- The 2016 guideline recommends intravenous magnesium sulphate should be the initial intravenous treatment for acute severe asthma when oral corticosteroids and nebulised bronchodilators have not improved the child's condition.

FURTHER READING

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